SECTION II

ENGINEERING REQUIREMENTS

N70-73641

The JPL guidelines for sterilization are based on the National Aeronautics and Space Administration (NASA) Unmanned Spacecraft Decontamination Policy (Appendix A), and other pertinent documents. The JPL guidelines cover two areas: (1) planetary lander sterilization criteria; and (2) spacecraft sterilization criteria.

A. CAPSULE CRITERIA

The following requirements define the engineering parameters that cognizant engineers must use as a part of the development of sterilizable hardware:

Guideline 1: The probability of landing a viable organism on Mars shall be less than 1 in 10,000.

Guideline 2: All hardware (including experiments) that are included in a planetary lander must be capable of withstanding both heat sterilization and ethylene oxide (ETO) exposure. These environments are defined in JPL Environmental Test Specification XSO-30275-TST-A, April 1963, "Compatibility Test For Planetary Dry Heat Sterilization" and GMO-50198-ETS-A, December 1963, "Ethylene Oxide Decontamination Requirement".

The guidelines apply to the hardware that impacts the planet's atmosphere, and the interface between this hardware and the spacecraft. The guidelines represent the present best estimate of the constraints imposed upon the planetary lander by the sterilization requirement and will be used in the assay and certification work in EASL.

A recapitulation of these specifications follows:

a. Heat Specification (XSO-30275-TST-A)

(1) For Type Approval Testing (TA)
(nonflight hardware)
145°C for 36 hours, 3 cycles.

(2) For Flight Acceptance Testing (FA)
135°C for 24 hours, 1 cycle.
The flight acceptance test will provide steril equipment.

b. Ethylene Oxide (ETO) Decontamination (GMO-50198-ETS)

(1) Type Approval

12 percent ethylene oxide and 88 percent Freon 12 (ETO-F12) environment for

24 hours at 24°C

24 hours at 40°C for 2 cycles

NOTE: Ethylene oxide is, at this time, considered a decontaminant and not a sterilant. The function of ETO is to reduce the microbial load.

(2) Flight Acceptance

(To be developed)

To guarantee both mission success and certification of capsule sterility, the most probable sequence of sterilization operations will be to:

(a) Flight acceptance test all subsystems at 135°C for 24 hours as a first test in the FA sequence.

(b) Prior to flight provide for a completely assembled lander system terminal heat sterilization of 135°C for 24 hours.

This sequence is contingent on all flight equipment being assembled, tested and transported under environmental conditions that keep the microbial loads to a minimum. Ethylene oxide decontamination may be used to reduce the load from surfaces.

After terminal heat sterilization it will be necessary to maintain the sterility of the capsule. A biological barrier must be provided. The capsule shall be protected from contamination by the environment (such as personnel, unsterile liquids, gases, solids, and any other unsterile atmosphere).

After separation of the capsule from the spacecraft any unsterile portion of the interface and the biological barrier shall not impact the planet with a probability consistent with Guideline 1.

B. SPACECRAFT CRITERIA

The spacecraft mission will provide:

1) That the probability of landing a viable organism on Mars will be less than 1 in 10,000.

2) That contamination of the planet Mars by an orbiting spacecraft will be such that no unsterile portions of the spacecraft will impact the Martian surface within 50 years, consistent with the Guideline 1.